

Habitat partitioning by two sympatric *Turdoides* species in the vicinity of lake Naivasha, Kenya

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Abstract: Two species of babblers, Black-lored Babbler (*Turdoides sharpei*) and Arrow-marked Babbler (*Turdoides jardeneii*) are sympatric around lakes Naivasha and Nakuru, Kenya. This study was carried out to assess the habitat partitioning mechanisms of the two species around Lake Naivasha area. The characteristics of habitats used by seven groups of each species were studied along the shorelines of lakes Naivasha and Oloiden. The two species differed significantly in the habitat characteristics. Arrow-marked Babbler is restricted to shorelines with dense tree and ground vegetation cover while Black-lored Babbler occupies open areas with sparsely distributed small trees and short ground vegetation cover. Observations on the feeding habits and social behaviours of the two species are also discussed.

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Introduction

Babblers are insectivorous, thrush-like terrestrial birds of gregarious habits, with distinctive babbling calls. They belong to the family Timaliidae, which contains about 250 species all over the world (Williams & Arlott 1980; Newman 1992; Macneal 1994). Most of the species are restricted to the tropics, of which nine are found in Kenya (EANHS, 1996). Two species, Black-lored Babbler (*Turdoides sharpei*) and Arrow-marked Babbler (*Turdoides jardeneii*) are locally common residents in Kenya. Their distribution, however, extend further down to southern Africa. Arrow-marked Babblers are stocky birds which occur in noisy parties of six to ten individuals in woodland mixed bushed, wooded hillsides and stands of exotic trees, usually in the lower stratum. They are greyish-brown birds, paler under parts with white arrow-shaped tips to the feathers of throat and breast; eye conspicuously yellow or orange (Newman 1992). The Black-lored Babbler is also greyish-brown in colour like Arrow-marked Babbler but with black lores and bluish-white eyes. They inhabit acacia bush and woodland, often near water, and papyrus and reed-beds (Williams & Arlott 1990). In Kenya, the two species are sympatric around lakes Naivasha and Nakuru (Zimmerman *et al.* 1996). This study was carried out to investigate the interactions between these two species, their habitat partitioning strategies. We also tried to investigate the characteristics of

the habitat used by the two species and their feeding habits to infer about their mechanisms of habitat use and coexistence strategies.

Study area and methods

The study was carried out in the woodland vegetation, along the shores of Naivasha and Oloiden lakes (0° 45' S, 36° 20'E). Lake Naivasha is one of Kenya's Rift Valley lakes situated at an altitude of 1890 m and with an area of 160-km² water surface. Lake Oloiden is a small cut-off lake, separated from Naivasha Lake by a narrow ridge of land. The habitat along the shore is composed of *Acacia* woodland, papyrus and thick herbaceous ground cover. The structure and composition of the vegetation changes as the distance from the shore lines increases, from tall trees with dense ground vegetation to sparsely distributed trees with short ground vegetation. *Acacia* woodlands with tall trees and tall herbaceous ground cover are more common along the shore lines, while shrub and short grass cover become dominant beyond a certain limit away from shore.

The location of seven different groups of both species was identified by visiting the study sites early in the morning when birds are most active. The sites of these groups were identified on arrival before any data recording began. Each group was visited only once and behavioural study was carried out on the same day as group identification. All observations were carried out between 8:00-12:30 am.

'Scan' watches of each group were conducted at 5 min interval for a total period of 60 min. Perch trees and feeding sites used by the birds during 'scan' watches were marked. Habitat characteristics were measured immediately after 'scan' watches completed at each site.

Total height, perch height, diameter at breast height, and

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foliage density of five perch trees per groups were recorded. For feeding habitat characterisation, four plots of 100 m² were investigated around the place where individuals of each group were seen feeding. Parameters recorded at feeding site plots were number of trees or shrubs, height, DBH, foliage density, and proportion of ground vegetation cover in different height classes. For foliage density or canopy cover estimation, we used spherical densiometer (Lemon 1956). The ground cover herbaceous vegetation was categorised in height classes of 0-20 cm, 20-40 cm, and >40 cm, and the percentage cover of each class within the plot was recorded. Direct observation method was used to record behaviours and feeding habits.

Statistical analysis was carried out using Microsoft Excel and MINITAB computer programmes. Both parametric (t-test) and non-parametric (Chi-square and Mann Whitney U) tests analysis were used to investigate the different habitat characteristics used by the two species. The significance level of $\alpha = 0.05$ was adopted for all tests.

Results

The characteristics of perch trees used by the two species are presented in Appendix 1. Arrow-marked Babbler tended to use large trees and perches at a higher level above ground, while Black-lored Babbler used small trees or shrubs as perch. As indicated in Appendix 1, the perch preference of the species differs in terms of height and perch plant size. The results of the analysis of the perch tree characteristics are summarized in Table 1 and Fig. 1.

Table 1. Summary of statistical tests of significance in perch characteristics used by Black-lored Babble and Arrow-marked Babbler

Parameters	Probability	Significance
Total height	df=12, p=0.0005	***
Perch height	df=11, p=0.0336	**
Dbh	df=10, p=0.0006,	***
Foliage density	(n1=7, n2= 6) p=0.0124	*

Note: * indicates level of significance at $\alpha = 0.05$.

Differences in total height, DBH, and foliage density of perches used by the two species are statistically significant (Table 1). Arrow-marked Babbler used tall trees with larger diameter and denser canopy cover, whereas BLB used small trees or shrubs as perches. The results of the analysis of the measurements of feeding habitat characteristics are presented in Appendix 2 and Table 2.

Table 2 Summary of statistical tests of the vegetation characteristics in feeding sites of Black-lored Babble and Arrow-marked Babbler (At level of significance , $\alpha=0.05$)

Parameters	Probability	Significance
Number of trees	df=6.67, p=0.25	NS
Height of trees	df= 12, p=0.38,	NS
DBH	df=10, p=0.87,	NS
Canopy density	n1=n2=7, p=0.02	*
Ground cover	df=2, p<0.001	**

No significant differences were observed in number, height, and DBH of trees in the feeding sites. The two species differed significantly in the proportions of ground-cover vegetation and upper canopy cover. Black-lored Babbler tends to feed in open areas dominated by short grass ($0 < \text{height} < 20$), whereas Arrow-marked Babbler tends to feed in areas with more closed canopy cover with tall and thick herbaceous ground vegetation.

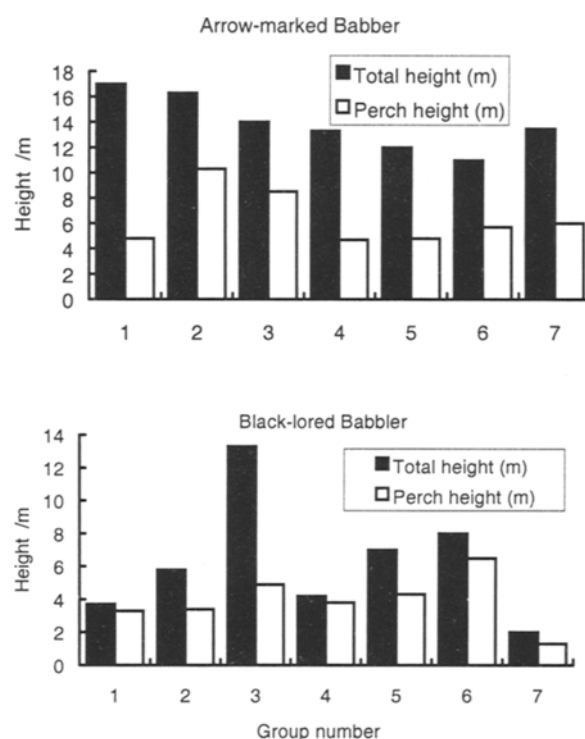


Fig. 2 Average height of trees and perch height used by different groups of Black-lored Babble and Arrow-marked Babbler

Both Arrow-marked Babbler and Black-lored Babbler occur in medium size parties. For Arrow-marked Babbler, 32 individuals with 7 groups were recorded with group sizes in range of 2-7. Group size of 5 was most frequent for Arrow-marked Babble. Of the 32 total individuals of Arrow-marked Babble, only two young were recorded in one group. For Black-lored Babbler, 37 individuals in 7 groups, with group sizes ranging from 3-6, were recorded. The most frequent group size for Black-lored Babbler was 6. Five young individuals were recorded in three groups.

Discussion

Both species mostly feed on the ground, finding their food by digging with their beak. However, the characteristics of the micro-habitats of the two species differ significantly. Arrow-marked Babbler feeds in areas with more thick and tall herbaceous vegetation cover and a higher density canopy cover. This habitat selection might be cor-

related to the behaviour of the species and diet requirements. Arrow-marked Babblers appear to be a secretive species. They are relatively quiet, making them more difficult to detect than Black-lored Babbler. Moreover, our incidental observations on food items they take suggest that the species might feed specifically on insects or other small invertebrates. Arrow-marked Babblers are more restricted to woody habitat with tall ground-cover vegetation and sometimes open areas very close to dense vegetation cover. The canopy density of such habitats would be favourable for ground cover growth and ultimately, for harbouring more insects.

On the other hand, Black-lored Babblers commonly feed in open areas with less canopy cover and short ground vegetation cover, sometimes even on bare ground of exposed mineral soils. Such habitat use is related to the behaviour of the species. Individuals of this species are very conspicuous and obtrusive, and seem to tolerate human disturbance to a certain level. Such behaviour enables Black-lored Babbler to dwell on open and more exposed habitat. In addition, Black-lored Babbler appears to have wider range of food items. Zimmerman *et al.* (1996) mentioned that this species feeds only on insects and small invertebrates. We observed, though that they feed on waste disposed by people in gardens. From this observation and their feeding habits in open areas, a major dietary component of Black-lored Babbler might be mainly ground invertebrates of open areas and seeds. While feeding, they dig into the ground, tossing soil and litter cover aside with their beaks. Such behaviours and flexibility in terms of habitat use allowed this species to adapt to a wider range of habitats. Occasionally, both species pick food items from the surface of tree stems on which they perch.

The use of larger perches by Arrow-marked Babblers could be due to its shyness and secretive behavior. As mentioned earlier, both species rarely use tree trunks as substrate for foraging. Statistical analysis of total perch tree height and height of perch used by Arrow-marked Babbler showed that there is no relationship between the two parameters ($r=0.3$, $n=7$). In contrast, the use of smaller tree as perch by Black-lored Babbler is likely related to its preference to open feeding site rather than a particular advantage of using the perch.

Competition between the two species is avoided by their habitat use behaviour in which they partition different microhabitat types. Black-lored babbler is more common, possibly because of its wider range of diet and habitats. No substantial overlap of territories or mixing of parties of the two species was recorded and boundaries are defined by habitat characteristics rather than the territorial behaviours of the species.

The fact that Arrow-marked Babbler is restricted to denser ground and canopy vegetation cover habitat suggests that this species can be affected by habitat conversion. If there is dramatic change in vegetation cover and conversion of intact areas through grazing or other hu-

man-caused disturbances, the Arrow-marked Babbler might not be able to compete with the more adapted and wide ranging Black-lored Babblers. This might eventually lead to gradual exclusion of the species from the habitat.

The East Africa woodland habitat has undergoing severe changes over the last few decades, mainly due to permanent settlement, changes in farming practice, and drought (Zerihun and Mesfin 1990; Vijver *et al.* 1999; Ibrahim *et al.*, 1987). The woodland habitats in the Great Rift Valley in Ethiopia are highly disturbed due to land use changes as a result of new settlements and villagization (Zerihun and Mesfin 1990). Marked changes have occurred in the woody components of the East African savanna of Kenya and Tanzania during the last 25 years (Vijver, 1999), mainly due to drought. In the Sudan, decades of drought, changes in farming practices of the local community and introduction of mechanized agriculture have wiped out huge areas of savanna woodland (Ibrahim *et al.* 1987). Recent studies of the impact of such changes on bird species community showed that habitat conversion results in marked changes in species composition, though the overall species might not be affected (Wilson *et al.* 1997). Specialist species could face local extinction and endangerment due to habitat loss in this process. Tremendous examples can be given from other parts of the world as well, regarding the impact of habitat change on bird species. Perhaps, the single most important threat to bird species worldwide is habitat loss or disturbance. For instance, several bird species of eucalyptus woodlands in Australia (Ford *et al.*, 2001), endemic bird species on Pemba Island, Tanzania (Catry *et al.* 2000); Burrowing Owls in Canada (Clyton and Schmutz 1999) the Black-fronted Piping-guan in Brazil (Galetti *et al.* 1997) are prone to extinction due to loss of their habitat. Fjeldsa (1999) reported a marked decline in range-restricted bird species as the level of disturbance increase, from mature forest to highly disturbed forest, in Tanzania. Studies on grassland birds in Maine (Vickery *et al.* 1995) also showed that three edge species, Brown Thrasher (*Toxostoma rufum*), Common Yellow throat (*Geothlypis trichas*), and Song Sparrow (*Melospiza melodia*) were strongly affected by habitat disturbance.

Our study indicates that Arrow-marked Babbler is restricted to undisturbed dense woodland. Management of such woodlands should take into consideration the impact of disturbance on Arrow-marked Babbler and other habitat specific species to ensure the conservation of habitat and its bird communities. This also ensures sustainable use of rangelands, which benefits both the local community and animals therein. Field (1986) discusses the appropriated management practices recommended for such habitats, based on long-term research project. A detailed research on other groups of woodland birds and their response to changes in habitat characteristics is required to come up with a wholistic management recommendations for such woodlands, addressing both conservation and sustainable use issue.

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Appendix 1. Perch tree and perch height characteristics used by each group of Black-lored Babbler and Arrow-marked Babbler

Group	<i>Turdoides sharpei</i>				<i>Turdoides jardeneii</i>			
	Total height (m)	Perch height (m)	DBH (cm)	Foliage density (%)	Total height (m)	Perch Height (m)	DBH (cm)	Foliage density (cm)
Group I	3.7	3.3	4.1	10	17	4.8	45.5	26.3
Group II	5.8	3.4	8.5	8.8	16.3	10.3	25	32
Group III	13.3	4.9	15.5	18	14	8.5	33	27.5
Group IV	4.2	3.8	5.5	8	13.3	4.7	35	33.3
Group V	7	4.3	17.2	30.6	12	4.8	52.2	37
Group VI	8	6.7	15.2	9	11	5.7	34.3	25
Group VII	2	1.3	Shrubs	Shrubs	13.5	6	30	41
Mean	6.3±3.7 n=7	3.9±1.6 n=7	11±5.7 n=6	14.0±8.9 n=6	13.9±2.2 n=7	6.4±2.2 n=7	36.9±9.3n=7	31.7±5.9 n=7

Appendix 2. Characteristics of the feeding sites for Black-lored Babbler (BLB) and Arrow-marked Babbler (AMB)

Group	Number of tree		Height (m)		Foliage density (%)		DBH (cm)		Ground cover (%)					
									0 -20 cm		20-40 cm		> 40 cm	
	BLB	AMB	BLB	AMB	BLB	AMB	BLB	AMB	BLB	AMB	BLB	AMB	BLB	AMB
Group I	11	1	3.2	23.8	10	36.2	-	45.6	54	15	16	22	30	63
Group II	2.3	2.3	18	18.4	25	34.5	40.3	35.2	61.7	10	22.5	33.3	15.8	56.7
Group III	2	1.6	22.5	11.4	31.4	25.6	40.6	22	72.5	16.6	16.5	26.6	11	56.6
Group IV	0.4	2.3	3.3	15.5	10	29.6	3.5	30	75.3	36.7	8.7	16.7	16	46.6
Group V	5.0	2.6	10	27.5	31.5	30.5	29	7.7	56.7	27	10	17	33.3	56
Group VI	1.2	0.6	9.8	7.7	11	31.7	21.6	38.3	80.0	52	6.2	21	12.8	27
Group VII	1.5	0.5	16.1	5	15	80.0	36.6	30	79.2	10	15	30	5.8	60